

SPECIES OF CERATOBAEUS ASHMEAD (HYMENOPTERA: SCELIONIDAE) FROM SOUTH-EASTERN AUSTRALIA

by A. D. AUSTIN*

Summary

AUSTIN, A. D. (1984) Species of *Ceratobaeus* Ashmead (Hymenoptera: Scelionidae) from South Eastern Australia. *Trans. R. Soc. S. Aust.* **108**(1), 21-34, 12 June, 1984.

Five species of *Ceratobaeus* Ashmead that were previously ill-defined are redescribed to facilitate their accurate identification. Types are designated for *Ceratobaeus clubionus* Austin, *C. cuspidatus* Austin and *C. masneri* Austin. *Ceratobaeus intrudae* sp.nov., *C. platycornutus* sp.nov. and *C. riekii* sp.nov. are described and the male of *C. setosus* Dodd is recorded for the first time. Notes on the diagnosis, biology and distribution of the above species, and some general comments on the genus in Australia, are also provided.

KEY WORDS: *Ceratobaeus*, Scelionidae, Araneae, ovipositor, host specificity.

Introduction

Ceratobaeus Ashmead is a large genus containing at least 40 described species. They occur worldwide, but are most diverse in the tropics and subtropics. Available host records¹ suggest that members of *Ceratobaeus* are exclusively parasites of spider eggs. They display a high degree of host specificity and cause significant levels of mortality for some spiders (Austin, in press).

The majority of Australian *Ceratobaeus* were described in the early part of this century by A. P. Dodd (1913, 1914a, 1914b, 1915, 1919), mostly from material collected by himself and A. A. Girault along the Queensland coast. Subsequently, Girault (1926) described a further species from Queensland, and V. V. Hickman (1967) described three species from Tasmania, which he reared from known spider hosts. Since then Austin (1981) has listed and placed the types of Australian species according to modern concepts, and Galloway & Austin (in press) have provided a diagnosis of the genus, along with a discussion of its biology, distribution and relationships with other genera.

The aim of the present paper is to describe three new species from south-eastern Australia, and to redefine a further five species whose descriptions are presently inadequate. Three

of the latter species (*C. clubionus*, *C. cuspidatus* and *C. masneri*) were referred to by Austin (1983) in a study of ovipositor mechanics of *Ceratobaeus* and related genera. Although he states that the names adopted are manuscript names only, the information presented in that paper constitutes their valid description under the International Code for Zoological Nomenclature (ICZN Articles 11, 13). However, the description of these species, along with those of *C. lamponae* (Hickman) and *C. setosus* Dodd, are inadequate in that they do not separate the species concerned from other species of *Ceratobaeus*. The status of these eight species is clarified here so that information from concurrent studies on their ecology (Austin in press; in prep.) can be published free of any taxonomic problems. Notes are provided on their distribution, hosts and relationships with other species. Additional diagnostic characters and general comments for the genus are also provided, which supplement those in Galloway & Austin (in press).

Methods

Specimen collection and preparation: Live wasps were obtained by rearing them from eggs of host spiders collected from the field. This provided valuable supportive information on host relationships and general biology. Other material was collected using yellow pan-traps and sweep-netting.

Specimens examined under SEM were prepared as follows: fresh material was killed, washed in 70% ethanol (5 min.), transferred to 100% ethanol (2 min.), and placed on a glass slide in a desiccator to dry (24 hr). Dry material (museum specimens) was softened in

* Department of Entomology, Waite Agricultural Research Institute, Glen Osmond, S. Aust. 5064. Present address: Commonwealth Institute of Entomology, British Museum (Natural History), Cromwell Road, London SW7 5BD, England.

¹ Austin, A. D. (1982). The biology and ecology of *Clubiona* species (Araneae: Clubionidae) and their scelionid parasitoids (Hymenoptera). Ph.D. thesis, University of Adelaide. Unpubl.

10% ethanol (30 min.) and treated as above. Specimens were then mounted on holders with electroconductive glue (DAG 915 silver paint) or double-sided adhesive tape, coated with 10 nm carbon and 30 nm gold-palladium, and viewed under an ETEC Autosean SEM operated at 5–20 keV. Some specimens were examined uncoated using the SEM in the Environmental Chamber Mode (Robinson 1980).

Material examined: The types of species described here, with the exception of *C. rieki*, were reared from a single host egg sac to ensure that the sexes of each species could be associated accurately (they are likely to be the offspring of one female). Males of some *Ceratobaeus* species are morphologically very similar and are difficult to separate. Therefore, the material listed in "Non-type specimens examined" has not been included in the type series in case males of other species have been wrongly associated. However, the chances of this having happened are slight, as there appears to be only a few species that attack hosts inhabiting the bark of eucalypt trees, the habitat from where most of the present species were collected. In most cases only one paratype female and male were coated for SEM: holotypes and allotypes were mounted on card-points so as to retain their colour.

Terminology: Morphological terms used throughout this paper are defined in Masner (1980) and Galloway & Austin (in press).

Abbreviations: ANIC = Australian National Insect Collection, CSIRO, Canberra; BMNH = British Museum (Natural History), London; CNC = Canadian National Collection of Insects, Arachnids and Nematodes, Ottawa; QDPI = Queensland Department of Primary Industries, Brisbane; SAM = South Australian Museum, Adelaide; WAITE = Waite Agricultural Research Institute, Adelaide; A.D.A. = specimens collected by A. D. Austin; Caringbah = a suburb of Sydney; Mylor = study site, 5 km south of Mylor, South Australia; H = height; L = length; W = width; S = metasomal sternite; T = metasomal tergite.

Genus CERATOBAEUS Ashmead

Ceratobaeus Ashmead 1893, pp. 167, 175; Kieffer 1926, p. 139; Masner 1976, p. 65; Huggert 1979, p. 7; Austin 1981, p. 83; Galloway & Austin (in press).

Type-species, *Ceratobaeus cornutus* Ashmead

Diagnosis: The genus has been adequately diagnosed in Masner (1976) and Galloway & Austin (in press); however, some additional useful characters are given below.

Head viewed anteriorly usually triangular or subtriangular in shape, sometimes with genae prolonged so as to be conical in shape towards the mandibles (similar to the condition in *Odontacanthus* Kieffer).

Forewings. Venation clearly delineated though sometimes only lightly coloured, with at least submarginal, marginal and stigmal veins present.

Metasoma. T7 external in female, usually triangular in shape, always visible when viewed from above; ovipositor held internally, extending to the apical end of horn on T1 (therefore as long as metasoma).

Comments: Of the genera comprising the tribe Idrini (see Austin 1981), *Ceratobaeus* is most closely related to *Idris*. Huggert (1979) has proposed that *Ceratobaeus* should be included under *Idris* as a subgenus, due to the apparent existence of intermediate forms. However, Austin (1981) maintains that they should be kept separate due to differences in the morphology of the metasoma and posterior mesosoma. *Idris* differs from *Ceratobaeus* in that T1 is always flat, the metasoma is never elongated, the propodeum is not excavated, and the propodeal disc is not divided into laminae. Also the length of the ovipositor differs between these two genera. *Ceratobaeus* species have very long ovipositors that are held internally within the metasoma and extend into the anteriorly projecting horn of T1. *Idris* species, however, have relatively short internal ovipositors that do not reach past the posterior margin of T2 (Austin 1983).

The length of the metasoma and horn vary substantially between species of *Ceratobaeus*, but remain constant within a species. In some species the horn is represented by a small hump, while in others it reaches dorsally above the mesosoma. The various stages in horn and metasomal length between these two extremes results in there being a corresponding series in the length of the ovipositor. Presumably such differences have evolved in response to varying accessibility of host eggs. Ovipositor length is well recognised as a factor involved in determining host specificity and subsequent speciation within the parasitic Hymenoptera (e.g. Askew 1971; Gibbons 1979; Heathcote &

Davis 1976; Price 1972), and undoubtedly a similar mechanism has operated in *Ceratobaeus*.

The morphology of the posterior mesosoma is closely tied to the size of the horn: species with large horns have the propodeum and scutellum more excavated than in species with short horns. Although males of *Ceratobaeus* have at most only a slight dorsal expansion on T1, many species still display some excavation of the posterior mesosoma. This excavation is always more pronounced in males of species where the female has a long horn (e.g. *C. cuspicornutus*, fig. 12).

Types (by present designation): holotype ♀, ANIC, South Australia: Mylor, 29.iii.1979, A.D.A., ex egg *Clubiona* sp. (Araneae). Paratypes reared from same egg sac as holotype—Allotype ♂, ANIC; Paratypes 2♂, 2♀, gold coated on SEM holders, antennae and wings of 1♂, 1♀ on slides, 1♂, 4♀, ANIC; 1♂, 4♀, CNC; 1♂, 4♀, QDPI; 1♂, 4♀, SAM; 1♂, 4♀, WAITE.

Female

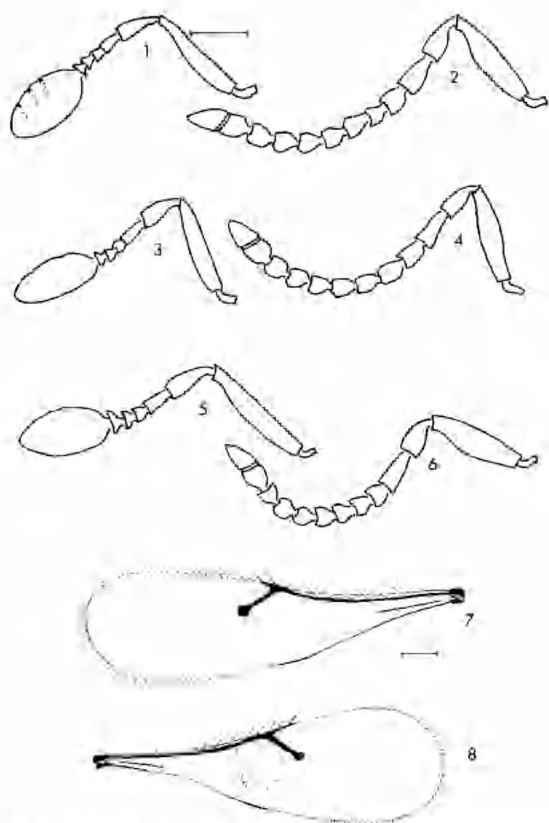
Length 1.3–1.4 mm. Colour. Head and mesosoma shiny black; antennae and legs light brown, almost yellow; antennal clubs and femora slightly darker; metasoma dark brown with lighter margin; posterior T1 and anterior T2 light brown.

Head. L:W:H (6.5:19:14), with granulate sculpturing and fine scattered hairs; dorsally, wider than mesosoma and arched around pronotum; occipital carina sharp; eyes large and hairy; lateral ocelli touching inner margins of eyes; frons slightly curved; anteriorly, head ovoid; occiput arched; eyes separated by $0.5 \times$ width of head; frons smooth; frontal carina weakly developed; laterally, gena with sides not quite parallel; antenna (fig. 17), club with 3 faint incomplete sutures.

Mesosoma. Dorsally, with coriaceous sculpturing and sparse short hairs (fig. 9); pronotum not visible; scutum wider than long, L:W (11:14); notauli absent; scutellum almost semi-circular, L:W (5.5:11), posterior margin with wide flange extending over metanotum, slightly inflected medially; metanotum narrow and crenulated; propodeum vertical and smooth, laminae diverging ventrally, extended into 2 small teeth dorsally (fig. 10).

Forewings not quite reaching to posterior margin of metasoma, not particularly broad. L:W (36:13); venation distinct, marginal and postmarginal veins short; stigmal vein long, basal vein present but lighter than other veins; lightly infuscated around apex of stigmal vein; marginal fringe of hairs moderately long (fig. 15).

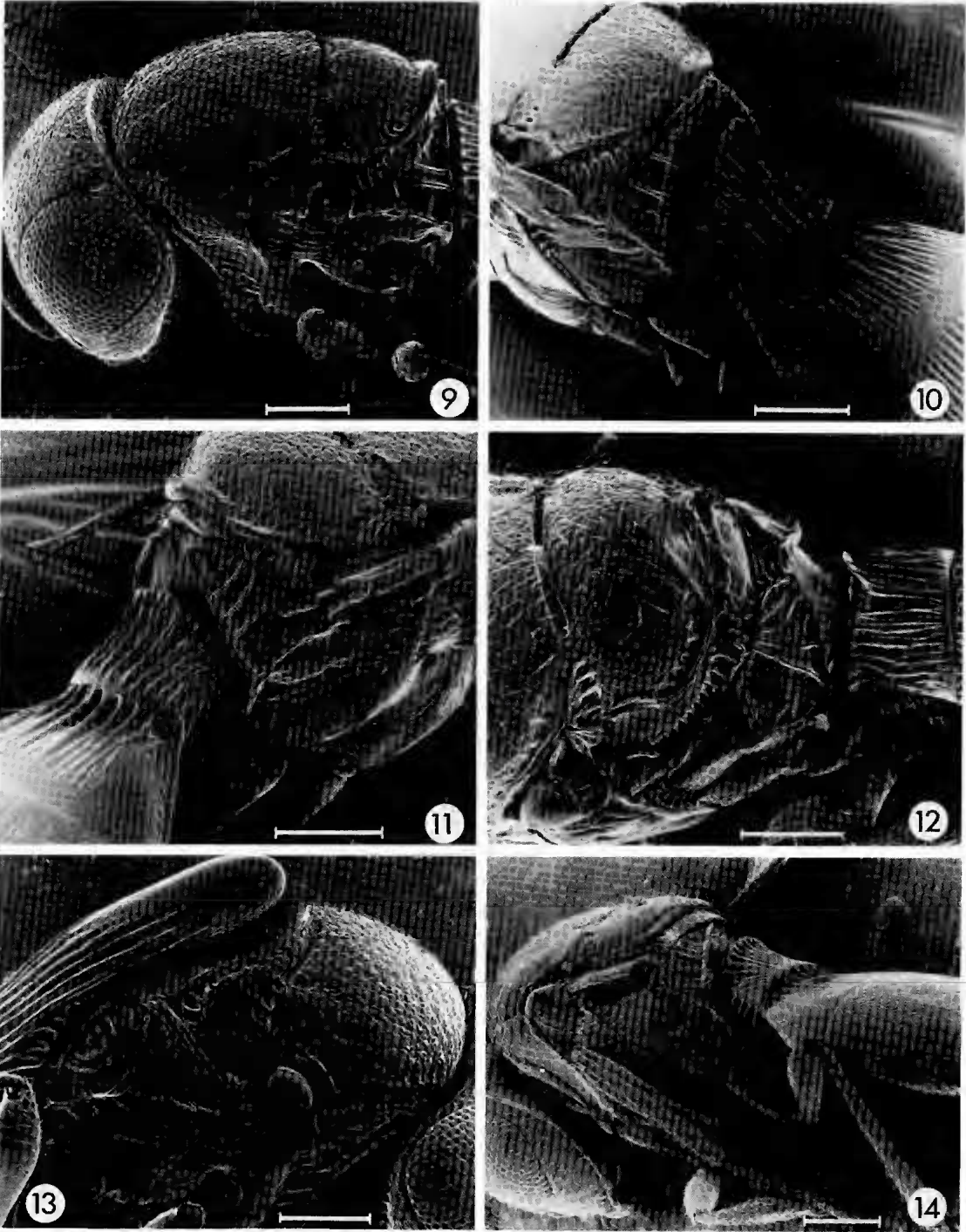
Metasoma wider than mesosoma, L:W (30:17), sparsely covered with hairs, pointed posteriorly; anterior T1 expanded into large hump, not reaching above propodeum (fig. 10); T1 and T2 with coarse longitudinal striations, T3 with lighter striations; lateral margins of T2–T3 and all T4–T6 with granulate sculpturing.



Figs 1–6. Antennae. 1. *Ceratobaeus cuspicornutus*, ♀. 2. *C. cuspicornutus*, ♂. 3. *C. masneri*, ♀. 4. *C. masneri*, ♂. 5. *C. platycornutus*, ♀. 6. *C. platycornutus*, ♂. Figs 7, 8. Forewings. 7. *C. cuspicornutus*, ♀. 8. *C. masneri*, ♀. Scale lines = 100 μ m. N.B. hairs and cilia not drawn on antennae and wings.

Ceratobaeus clubionus Austin FIGS 9–11, 15, 17, 18

Ceratobaeus clubionus Austin 1983, p. 151 (no types designated).



Figs 9-11. *Ceratobaeus clubionus*. 9. ♀, lateral view of head and mesosoma. 10. ♀, dorsolateral view of mesosoma and T1. 11. ♂, dorsoposterior view of mesosoma and T1. Figs 12, 13. *C. cuspicornutus*. 12. ♂, dorsal view of mesosoma and T1. 13. ♀, lateral view of mesosoma and T1. Fig. 14. *C. intrudae*, ♂, lateral view of whole body. Wings removed on all specimens. Scale lines 100 μ m.

Male

Differing from female in the following: length 1.2–1.3 mm; antenna (fig. 18); propodeal laminae diverging slightly more than in female; wings reaching well past posterior margin of metasoma; forewing L:W (46:19), marginal fringe of hairs long, venation dark, basal vein darker than in female; metasoma rounded posteriorly, wider than mesosoma, L:W (26:18); anterior T1 inflected dorsally into hump, but not as pronounced as in female (fig. 11).

Comments

C. clubionus parasitises the eggs of *Clubiona cycladata* Simon and an undescribed species of *Clubiona* (Clubionidae). These spiders inhabit the bark of eucalypt trees in the Mount Lofty Ranges, South Australia. This species can be distinguished from all other *Ceratobaeus* by its colour, the presence of a postmarginal vein, and the horn on T1 represented by only an anterior dorsal inflection of that tergite, i.e. not rounded dorsally.

Non-type specimens examined: SOUTH AUSTRALIA: 2♂, 6♀, 15.iii.1979, 2♂, 13♀, 18.xi.1979, Mylor, A.D.A., 1♂, 7♀, Myponga, 4.ii.1979, A.D.A., 1♂, 10♀, 3.ii.1979, 1♂, 5♀, 4.ii.1979, Strathalbyn, A.D.A. ANIC; 4♂, 27♀, Mylor, 1979, A.D.A.; 1♂, 1♀, Myponga, 4.ii.1979, A.D.A., BMNH; 8♀, 15.iii.1979, 1♂, 14♀, 13.iv.1979, Mylor, A.D.A., CNC; 1♂, 4♀, 13.ii.1979, 5♀, 9.iii.1979, 1♂, 5♀, 25.xi.1979, 1♂, 5♀, 7.xii.1979, Mylor, A.D.A., QDPI; 1♂, 5♀, 13.iv.1979, 2♂, 12♀, 20.i.1980, Mylor, A.D.A., SAM; 11♀, 23.i.1979, 2♂, 8♀, 13.ii.1979, Mylor, A.D.A., WAITE.

Ceratobaeus cuspidatus Austin

FIGS 1, 2, 7, 12, 13

Ceratobaeus cuspidatus Austin 1983, p. 151 (not types designated).

Types (by present designation): holotype ♀, ANIC, South Australia: Mylor, 18.ii.1979, A.D.A., ex egg *Clubiona* sp. (Araneae). Paratypes reared from same egg sac as holotype—Allotype ♂, ANIC; Paratypes 1♂, 2♀, gold coated on SEM holders, antennae and wings of ♂ and 1♀ on slides, 2♀ dissected on slides, 2♂, 2♀, ANIC; 1♂, 2♀, CNC; 1♂, 2♀, QDPI; 1♂, 2♀, SAM; 1♂, 2♀, WAITE.

Female

Length 1.50–1.75 mm. Colour. Head and mesosoma black; legs and antennae brown to dark brown; metasomal horn black and shiny; posterior T1 light brown; T2–T7 brown. Head wider than mesosoma, L:W:H (6:19:

15), with granulate sculpturing and short scattered hairs; dorsally, occipital carina sharp; eyes large, with very short hairs; lateral ocelli touching inner margins of eyes; frons slightly curved; anteriorly, head subtriangular in shape; occiput slightly depressed medially; eyes separated by slightly more than 0.5 × width of head; lower frons smooth and shiny; frontal carina weakly developed; laterally, gena large, margins parallel; antenna (fig. 1), club with 3 faint incomplete sutures.

Mesosoma strongly compressed anteroposteriorly; dorsally, with granulate sculpturing and scattered hairs; pronotum not visible; scutum much wider than long, L:W (9:14); notauli absent; scutellum transverse, L:W (1:10), with posterior fringe of long hairs; scutellum, metanotum and propodeum strongly excavated to receive horn, sloping away posteriorly towards metasoma; propodeal laminae parallel, not extended dorsally into small teeth (fig. 13); laterally mesosoma smooth and shiny.

Forewings not reaching past posterior margin of T4, fairly narrow, L:W (44:13); marginal vein short, stigmal vein long, postmarginal vein less than 0.5 × length of stigmal vein; marginal fringe of hairs moderately long (fig. 7).

Metasoma elongated, L:W including horn (55:17), slightly wider than mesosoma, with scattered hairs; horn long, angled forward into mesosomal cavity, reaching above level of scutellum; apical horn moderately pointed and smooth, striate laterally and basally (fig. 13) base of T1–T4 with longitudinal striations; lateral margins of T2–T3 and all T4–T7 with granulate sculpturing; T7 slightly elongated.

Male

Differing from female in the following: length 1.35–1.50 mm; antenna (fig. 2); dorsal mesosoma arched more than in female; scutellum more than 2 × wider than long, L:W (5:12), posterior margin rounded, inflected medially into small smooth triangular patch; posterior mesosoma not excavated but flat, sloping posteriorly towards metasoma; metanotum narrow and crenulated, visible from above; propodeum smooth; propodeal laminae diverging ventrally (fig. 12); wings reaching well past posterior metasoma; forewings moderately broad, L:W (55:20), basal vein darker than in female, but still faint compared to submarginal vein, marginal fringe of

hairs long; metasoma moderately elongated, rounded posteriorly, L:W (29:16); anterior T1 inflected dorsally, striations reaching to anterior margin of T1.

Comments

This species parasitises the eggs of *Clubiona cycladota* and an undescribed species of *Clubiona* (Clubionidae). These spiders inhabit the bark of eucalypt trees in the Mount Lofty Ranges, South Australia. *C. cuspicornutus* is related to a group of species that all have a long slightly curved horn and an elongate metasoma. It comes closest to *C. longicornutus* Dodd, but differs in having a darkly pigmented basal vein, a brown metasoma (not yellow) and a more elongate antennal pedicel.

Non-type specimens examined: SOUTH AUSTRALIA: 3♂, 9♀, 9.iii.1979, 10♀, 13.xi.1979, Mylor, A.D.A., ANIC; 2♂, 6♀, Mylor, 27.xii.1980, A.D.A., BMNH; 2♂, 4♀, Mylor, 15.iii.1979, A.D.A., CNC; 1♂, 6♀, Mylor, 13.xi.1979, A.D.A., QDPI; 2♂, 5♀, Mylor, 9.ix.1979, A.D.A., SAM; 2♀, 29.iii.1979, 3♀, 26.iii.1978, Mylor, A.D.A., WAITE.

Ceratobaeus intrudae sp. nov.

FIGS 14, 16, 19–22

Types: holotype ♀, ANIC, South Australia: Mt Compass, 4.ii.1979, A.D.A., ex egg *Intruda* sp. (Araneae). Paratypes reared from same egg sac as holotype—Allotype ♂, ANIC; Paratypes 1♂, 1♀, gold coated on SEM holders, antennae and wings on slides, 2♂, 2♀, dissected on slides, ANIC; 1♂, 1♀, CNC.

Female

Length 1.30–1.45 mm. Colour. Head and dorsal mesosoma very dark brown to black; legs, antennae and lateral mesosoma dark brown; metasoma with a light brown band behind horn and a medial brown patch occupying approximately two-thirds of T3, rest of metasoma dark brown to black.

Head wider than mesosoma, not strongly curved around pronotum, with granulate sculpturing and sparse short hairs, L:W:H (7.5:18:13); dorsally, occipital carina sharp; eyes large, covered with short hairs; lateral ocelli touching inner margins of eyes; frons slightly curved; anteriorly, head subtriangular in shape; occiput flat; eyes separated by more than 0.5 × width of head; frons lightly sculptured; frontal carina well developed, reaching half way to median ocellus; laterally, gena large, margins almost parallel; antenna (fig. 19), club with 3 faint incomplete sutures.

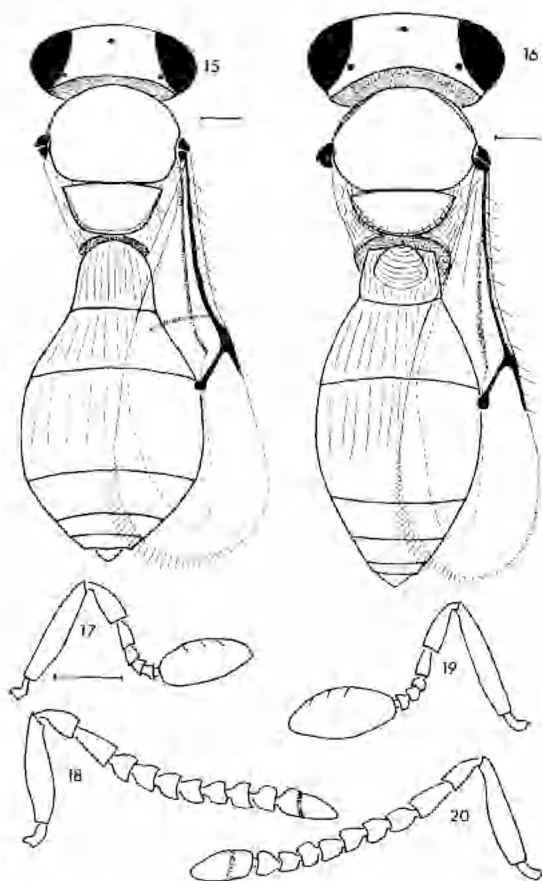


Fig. 15. *Ceratobaeus clubionus*, ♀, dorsal surface of whole body. Fig. 16. *C. intrudae*, ♀, dorsal surface of whole body. Figs 17–20. Antennae. 17. *C. clubionus*, ♀. 18. *C. clubionus*, ♂. 19. *C. intrudae*, ♀. 20. *C. intrudae*, ♂. Scale lines = 100 µm. N.B. hairs and cilia not drawn on antennae and wings.

Mesosoma. Dorsally, fairly flat, with granulate sculpturing and scattered hairs; pronotum visible at anterior corners; scutum wider than long, L:W (10:14.5); notauli absent; scutellum almost semi-circular, L:W (4:11), posterior border crenulated, with a narrow flange (fig. 22); metanotum narrow and crenulated; propodeum vertical and smooth; laminae curving dorsally, extended into 2 small teeth (fig. 21); laterally, mesosoma smooth and shiny.

Forewings narrow, not quite reaching to posterior margin of metasoma, L:W (38:12.5); marginal vein short, stigmal vein long, postmarginal vein as long as stigmal vein, basal vein present but very faint; infuscated around

apex of stigmal vein; marginal fringe of hairs short (fig. 16).

Metasoma slightly wider than mesosoma and $2 \times$ longer than wide, L:W (32:16), with scattered hairs, pointed posteriorly; horn almost vertical, just reaching above level of posterior scutellum, with circular striated sculpturing apically (figs. 21 and 22); T1 behind horn and T2-T3 with longitudinal striations; lateral T2-T3 and all T4-T6 with granulate sculpturing.

Male

Differing from the female in the following: dorsally, head slightly more curved around pronotum, only slightly wider than mesosoma, L:W:H (7.5:17:13); antenna (fig. 20); propodeum not quite vertical, sloping away slightly towards metasoma; propodeal laminae slightly wider than in female; wings reaching well past posterior metasoma; forewing L:W (42:16), marginal fringe of hairs long; metasoma rounded posteriorly, L:W (25:16); anterior T1 strongly inflected dorsally, not reaching above propodeal laminae; without striate or punctate sculpturing, but with longitudinal striations extending to anterior margin (fig. 14).

Comments

C. intrudae parasitises the eggs of an unknown species of *Intruda* (Gnaphosidae), the latter being found under the bark of eucalypt trees in the Mount Lofty Ranges, South Australia. This species is related to a large group, all with moderately short horns. However, *C. intrudae* can be distinguished from all other species by the following combination of characters: apical horn with circular striae, metasoma twice as long as wide, colour as in description.

Non-type specimens examined: SOUTH AUSTRALIA: 1♂, 3♀, Bridgewater, 26.iii.1979, A.D.A., ANIC; 1♂, 4♀, Bridgewater, 26.iii.1978, A.D.A., SAM.

Ceratobaeus lamponae (Hickman)

FIGS 23-25

Odontacolus lamponae Hickman 1967, p. 18.

Ceratobaeus lamponae (Hickman); Masner 1976, p. 66; Austin 1981, p. 84.

Types: holotype ♀ on slide, ANIC: Tasmania, Domain, Hobart, 29.xii.1966, V. V. Hickman, ex egg *Lampona cylindrata* (L. Koch) (Araneae); Paratypes 2♂, 1♀, on same slide as holotype.

Female

Length 1.60-1.85. Colour. Head, mesosoma and horn shiny black; antennae and metasoma dark brown to black; legs brown.

Head. L:W:H (9:22.5:16), with moderately coarse punctate-reticulate sculpturing, covered with long hairs; dorsally, wider than mesosoma, arched around pronotum; occiput well exposed; occipital carina sharp, moderately angled at corners; eyes large, with long hairs; lateral ocelli touching inner margins of eyes; frons straight; anteriorly, head subtriangular in shape; occiput straight; eyes separated by slightly less than $0.5 \times$ width of head; frons flat, with horizontal striae; frontal carina very small; laterally, gena with margins parallel, rounded ventrally; antennal scape L:W (31:6), pedicel (13:5.5), club (27:12) with 3 faint incomplete sutures.

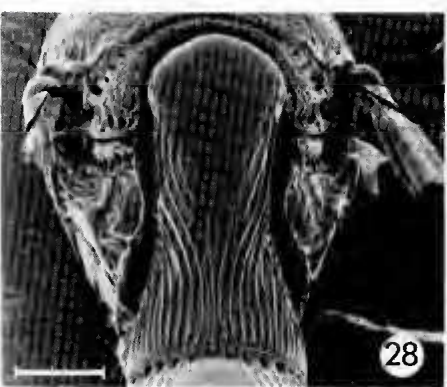
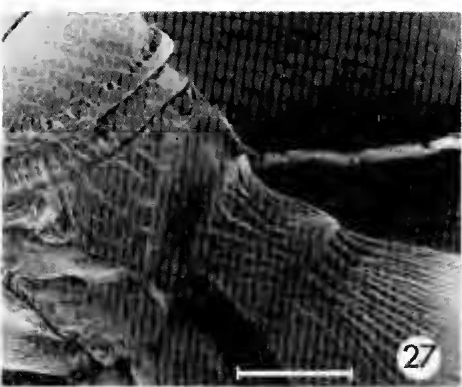
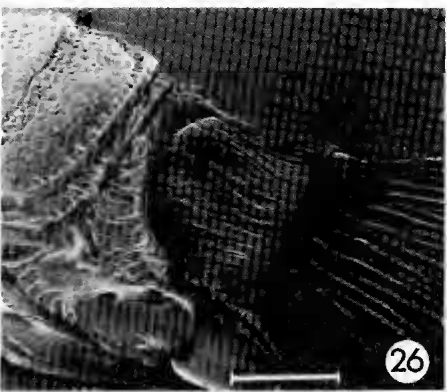
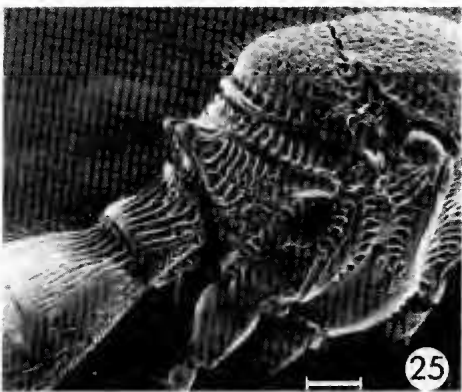
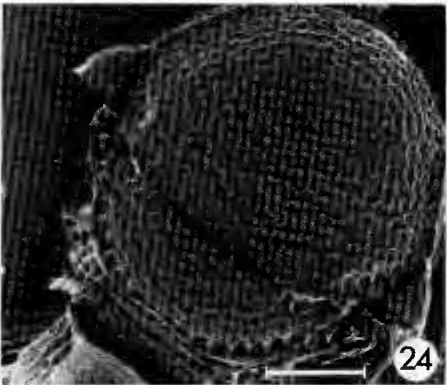
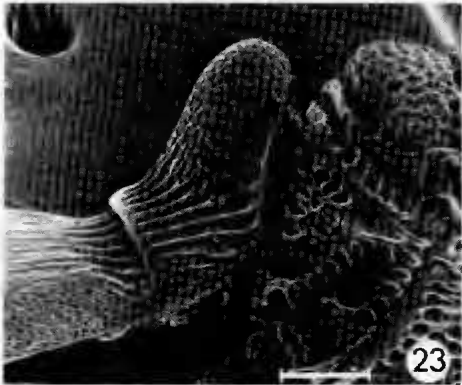
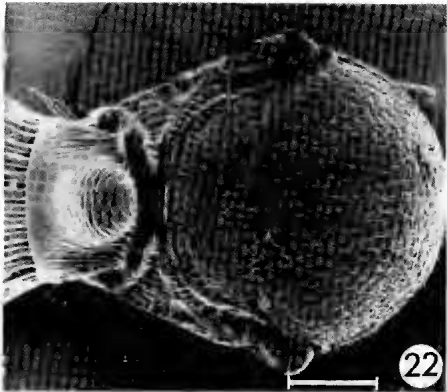
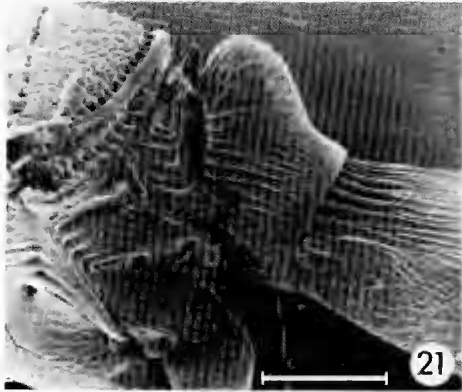
Mesosoma dorsally, with moderately coarse punctate-reticulate sculpturing, sparsely covered with long hairs (fig. 24); pronotum visible at anterior lateral corners; scutum wider than long; L:W (13.5:17.5); notauli absent; scutellum almost $3 \times$ wider than long, L:W (4:12), posterior margin straight, fringe of long hairs projecting over horn often present; metanotum and propodeum flat; metanotum narrow and crenulated; propodeal laminae diverging ventrally, extended dorsally into blunt teeth; lateral propodeum and mesopleura margined by single rows of deep pits (fig. 23).

Forewings not quite reaching to posterior margin of metasoma, moderately broad, L:W (73:27), infuscated medially; venation clear and dark; marginal vein short, postmarginal vein as long as stigmal vein, basal vein light; marginal fringe of hairs moderately long.

Metasoma wider than mesosoma, L:W including horn (42:22), covered with long hairs; horn just reaching to level of dorsal scutellum, apical two-thirds with coriaceous sculpturing almost scaly in appearance (fig. 23); T1 including basal one-third of horn and T2 with longitudinal striations, T3 strigose with background granulate sculpturing, T4-T6 with granulate sculpturing.

Male

Differing from female in the following: length 1.55-1.70 mm; dorsally, scutellum more rounded, though slightly flattened posteriorly, $2 \times$ wider than long, L:W (6.5:



12.5); propodeum flat, almost vertical; propodeal laminae wide, with coarse striate sculpturing, strongly diverging ventrally, extended into 2 blunt teeth dorsally which almost touch medially (fig. 25); wings reaching well past posterior metasoma; forewing L:W (83:32), well infuscated, marginal fringe of hairs long; metasoma subpedunculate, wider than mesosoma, with scattered long hairs, L:W (35:25), anterior T1 inflected dorsally; T1-T2 and anterior T3 with longitudinal striations, lateral T2 and rest of metasoma with granulate sculpturing.

Comments

C. lamponae (Hickman) parasitises the eggs of *Lampona cylindrata* (L. Koch) (Gnaphosidae); the latter being widespread throughout Australia. *C. lamponae*, previously only known from Tasmania, is recorded from mainland Australia (Mount Lofty Ranges, South Australia) for the first time. There appears to be some minor geographic variation in this species. Some specimens from Tasmania have the posterior fringe of hairs on the scutellum very short or absent, while mainland specimens have a very long fringe. *C. lamponae* can be distinguished from other species by its colour, presence of a postmarginal vein and characteristic sculpturing on the horn and dorsal mesosoma.

Non-type specimens examined: SOUTH AUSTRALIA: 1♂, 1♀, gold coated on SEM holders, antennae and wings on slides, 2♂, 11♀, Mylor, 29.iii.1979, A.D.A., ANIC; 6♂, 10♀, Mylor, 20.i.80, Mylor, A.D.A., BMNH; 4♂, 8♀, Mylor, 20.i.1980, A.D.A., CNC; 1♂, 11♀, Mylor, 29.iii.1979, A.D.A., QDPI; 4♂, 6♀, Mylor, 20.i.1980, A.D.A., SAM; 1♂, 6♀, Mylor, 14.xii.1979, A.D.A., WAITE. TASMANIA: 1♂, 11♀, Domain, Hobart, 9.iii.1967, V. V. Hickman, ANIC; 3♂, 11♀, Domain, Hobart, 29.xii.1967, V. V. Hickman, CNC.

Ceratobaeus masneri Austin

FIGS 3, 4, 8, 26, 27

Ceratobaeus masneri Austin 1983, p. 143 (no types designated).

Types (by present designation): holotype ♀, ANIC, South Australia; Mylor, 18.ii.1979, A.D.A., ex egg *Clubiona* sp. (Araneae). Paratypes reared

from same egg sac as holotype—Allotype ♂, ANIC; Paratypes 2♂, 3♀, gold coated on SEM holders, antennae and wings of 1♂, 1♀ on slides, 4♂, 4♀, ANIC; 1♂, 4♀, CNC; 1♂, 4♀, QDPI; 1♂, 4♀, SAM; 1♂, 4♀, WAITE.

Female

Length 1.25–1.40 mm. Colour. Head and mesosoma black; antennae and legs brown; metasoma dark brown; T1 light brown, but with apex of horn brown to dark brown.

Head wider than mesosoma. L:W:H (7:18:13), arched around pronotum, with granulate sculpturing and scattered short hairs; dorsally, occipital carina sharp; eyes large and hairy; lateral ocelli touching inner margins of eyes; frons curved; anteriorly, head subtriangular in shape; occiput curved; eyes separated by slightly more than 0.5 × width of head; frons smooth; frontal carina weakly developed, reaching 0.5 × distance to median ocellus; laterally, gena wide, sides not parallel; antenna (fig. 3).

Mesosoma. Dorsally, with granulate sculpturing and scattered hairs; pronotum not visible; scutum wider than long, L:W (9:12); notauli absent; scutellum L:W (4.5:10), rounded posteriorly, with crenulated border, slightly inflected medially; metanotum narrow and crenulated; propodeum vertical and smooth; laminae diverging ventrally and curved dorsally into 2 small teeth, laterally with coarse striations (fig. 26).

Forewings just reaching to posterior margin of metasoma, fairly narrow, L:W (40:13); marginal vein short, stigmal vein long, postmarginal vein approximately 0.75 × length of stigmal vein, basal vein present but faint; marginal fringe of hairs short (fig. 8).

Metasoma wider than mesosoma, nearly 2 × longer than wide, L:W (35:19), pointed posteriorly, sparsely covered with hairs; T1 expanded into a small dorsal horn, not reaching to level of scutellum (fig. 26); apex of horn with faint punctate sculpturing; most of horn, posterior T1 and T2–T3 with longitudinal striations; lateral margins of T2, background of T3 and all T4–T6 with granulate sculpturing.

Figs 21, 22. *Ceratobaeus intradac*, ♀. 21. Lateral view of mesosoma and T1. 22. Dorsal view of mesosoma and T1. Figs 23–25. *C. lamponae*. 23. ♀, lateral view of mesosoma and T1. 24. ♀, dorsal view of mesosoma. 25. ♂, lateral view of mesosoma and T1. Figs 26, 27. *C. masneri*. 26. ♀, dorsolateral view of mesosoma and T1. 27. ♂, dorsolateral view of mesosoma and T1. Fig. 28. *C. platycornutus*, ♀, dorsoposterior view of mesosoma and T1. Wings removed on all specimens. Scale lines = 100 µm.

Male

Differing from female in the following: length 1.20–1.35 mm; antenna (fig. 4); hairs on dorsal surface of mesosoma slightly longer than in female; scutellum slightly arched dorsally; lateral propodeum with fine sparse striations; wings reaching well past posterior margin of metasoma; forewing L:W (49:18), venation same as female, but with basal vein more obvious, almost as dark as submarginal vein, marginal fringe of hairs long; metasoma rounded posteriorly, L:W (27:16.5); anterior T1 inflected dorsally, only reaching to 0.5 × height of propodeum, striations reaching to anterior margin of T1 (fig. 27).

Comments

C. masneri parasitises the eggs of *Clubiona robusta* L. Koch, *Cl. cycladata*, an undescribed species of *Clubiona* (Clubionidae) and *Hemicloea* sp. (Gnaphosidae): all inhabit the bark of eucalypt trees throughout south-eastern Australia. So far *C. masneri* has been collected from locations in South Australia, Victoria and the Australian Capital Territory. This species belongs to a large group that all have short horns. However, *C. masneri* can be recognised from all other species by the presence of a postmarginal vein, a darkly pigmented basal vein, and its colour (see description).

Non-type specimens examined: AUSTRALIAN CAPITAL TERRITORY: 6♀, Canberra, 14.i.1980, A.D.A., ANIC. SOUTH AUSTRALIA: 13♀, 20.i.1979, ex eggs *Clubiona* sp. (Araneae), 6♂, 14♀, 13.xi.1979, ex eggs *Hemicloea* sp. (Araneae), Mylor, A.D.A., ANIC; 10♂, 17♀, Mylor, 1978–80, A.D.A., 1♀, Myponga, 4.ii.1979, A.D.A.; 7♂, 33♀, Mylor, 10.iii.1980, A.D.A., ex eggs *Hemicloea* sp., CNC; 4♂, 6♀, 1.xii.1979, 2♂, 6♀, 20.i.1980, Mylor, A.D.A., QDPI; 5♂, 6♀, Mylor, 17.ii.1980, A.D.A., SAM; 7♀, 15.iv.1979, 11♀, 12.viii.1979, Mylor, A.D.A., WAITE. VICTORIA: 1♂, 9♀, Woorndoo, 26.ix.1979, A.D.A., SAM.

Ceratobaeus platycornutus sp. nov.

FIGS 5, 6, 28, 29

Types: holotype ♀, ANIC, Australian Capital Territory: University campus, Canberra, 14.i.1980, A.D.A., ex egg *Clubiona* sp. (Araneae). Paratypes

reared from same egg sac as holotype—Allotype ♂, ANIC; Paratypes 2♂, 2♀, gold coated on SEM holders, antennae and wings of 1♂, 1♀ on slides, 2♂, 7♀, ANIC; 1♂, 4♀, CNC; 1♂, 4♀, QDPI; 1♂, 4♀, WAITE.

Female

Length 1.75–1.85 mm. Colour, Head, mesosoma and apical horn black; antennae, legs and metasoma dark brown; anterior metasoma behind horn, with a light brown band.

Head wider than mesosoma, L:W:H (7:20:15), arched around pronotum, with granulate sculpturing, sparsely covered with hairs; dorsally, occipital carina sharp; eyes large, with fine hairs; lateral ocelli touching inner margins of eyes; frons curved; anteriorly, head subtriangular in shape; occiput straight; eyes separated by 0.5 × width of head; frons lightly punctate; frontal carina very small; laterally, gena wide, sides almost parallel; antenna (fig. 5).

Mesosoma strongly compressed antero-posteriorly; dorsally, with granulate sculpturing and scattered hairs; pronotum not visible; scutum wider than long, L:W (10:15); notauli absent; scutellum transverse, L:W (1:10), scutellum, metanotum and propodeum all strongly indented posteriorly, sloping towards metasoma; propodeal laminae vertical, curved outwards ventrally, without dorsal teeth (fig. 28).

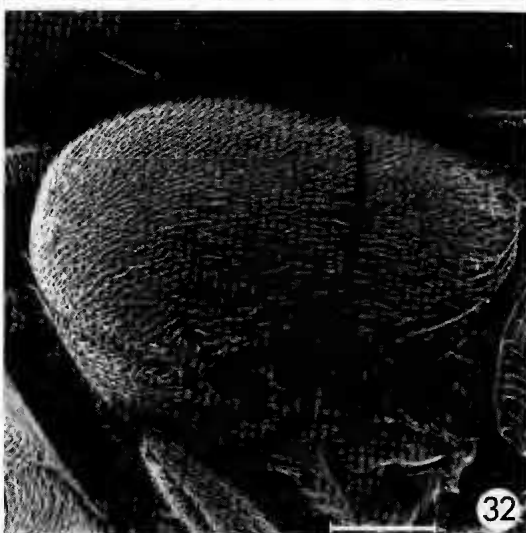
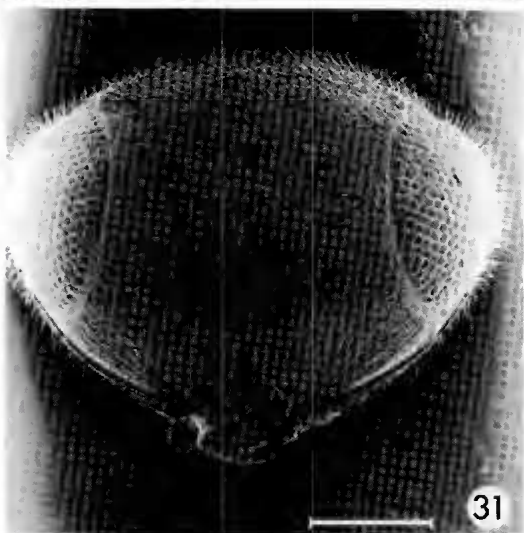
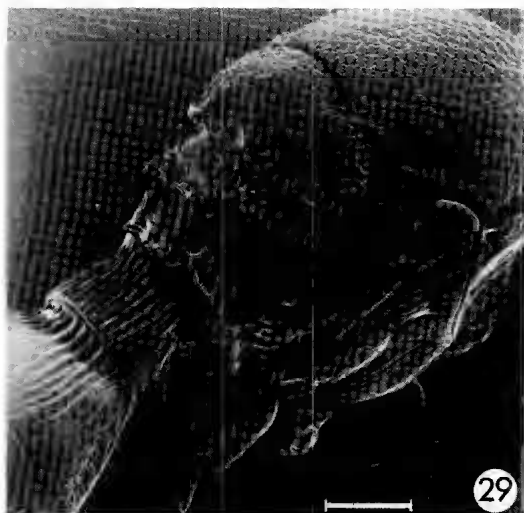
Forewings reaching to posterior margin of T4, fairly narrow, L:W (71:23); lightly infuscated medially; marginal vein short, stigmal vein long, postmarginal vein less than 0.5 × length of stigmal vein, basal vein light; marginal fringe of hairs moderately long.

Metasoma elongated, L:W including horn (56:18), wider than mesosoma; horn long, slightly arched, projecting anteriorly, closely fitting to mesosoma, reaching above level of scutellum, flattened and disc-shaped apically (fig. 28); T1 except for apical portion of horn and T2–T4 with longitudinal striations; lateral T2–T4 and all T5–T7 with light granulate sculpturing.

Male

Differing from female in the following: length 1.4–1.5 mm; antennae and legs yellow;

Fig. 29. *Ceratobaeus platycornutus*, ♂, dorsolateral view of mesosoma and T1. Fig. 30. *C. rieki*, ♀, dorsolateral view of head, mesosoma and T1. Figs 31–34. *Ceratobaeus setosus*, 31. ♀, anterior view of head, antennae missing. 32. ♀, dorsolateral view of mesosoma. 33. ♀, lateral view of mesosoma and T1. 34. ♂, lateral view of mesosoma and T1. Wings removed on all specimens except on one side of specimens in Figs. 32 and 33. Scale lines = 100 µm.



metasoma dark brown to black, with light brown band anteriorly; antenna (fig. 6); head not as high, L:W:H (7:20:13.5); scutellum almost semicircular, slightly indented posteriorly to form smooth triangular patch; metanotum and propodeum flattened and smooth; propodeal laminae diverging ventrally; wings reaching well past metasoma; forewings broad, L:W (80:31), postmarginal vein not as long as in female, basal vein slightly darker, marginal fringe of hairs long; metasoma not as elongated, L:W (30:20); anterior T1 inflected dorsally (fig. 29); T1-T3 with longitudinal striations; rest of metasoma with light punctate sculpturing.

Comments

The specific name *platycornutus* (*platys* in Latin, broad or flat; *cornutus*, horn) refers to the flattened, disc-shaped apical end of the metasomal horn. This species has been recorded as parasitising the eggs of an undescribed species of *Clubiona* (Clubionidae) inhabiting bark of eucalypt trees in the Australian Capital Territory. *C. platycornutus* is very similar to *cuspicornutus* and *longicornutus*, but differs in the shape of the metasoma horn (see comments under *cuspicornutus*).

Non-type specimens examined: AUSTRALIAN CAPITAL TERRITORY: 4♂, 11♀, University campus, Canberra, 10.i.1980, A.D.A., ANIC.

Ceratobaeus ricki sp. nov.

FIGS 30, 35, 39

Types: holotype ♀, ANIC, New South Wales: 10 ml. E. Trangie, 20.x.1949, E. F. Rick; Paratypes 1♀, gold coated on SEM holder (mesosoma missing), wings on slide, 1♀ dissected on slide, 13♀, ANIC; same data as holotype.

Female

Length 2.1-2.3 mm. Colour. Head and mesosoma black; antennae dark brown; legs brown; metasoma dark brown to black. Head. L:W:H (7:20:14.5), with granulate sculpturing covered with short hairs; dorsally, slightly wider than mesosoma; occiput excavated and arched around pronotum; occipital carina sharp, not angled at corners; eyes large and hairless; lateral ocelli touching inner margins of eyes; frons slightly arched; anteriorly, head subtriangular; occiput slightly depressed medially; eyes separated by slightly more than $0.5 \times$ width of head; frons smooth; frontal carina not developed; laterally, gena with margins parallel; antenna (fig. 39), club large with 3 faint incomplete sutures.

Mesosoma strongly compressed anterioposteriorly, posterior surface sloping towards metasoma; dorsally, with punctate-granulate sculpturing, covered with short hairs; pronotum not visible; scutum $2 \times$ wider than long, L:W

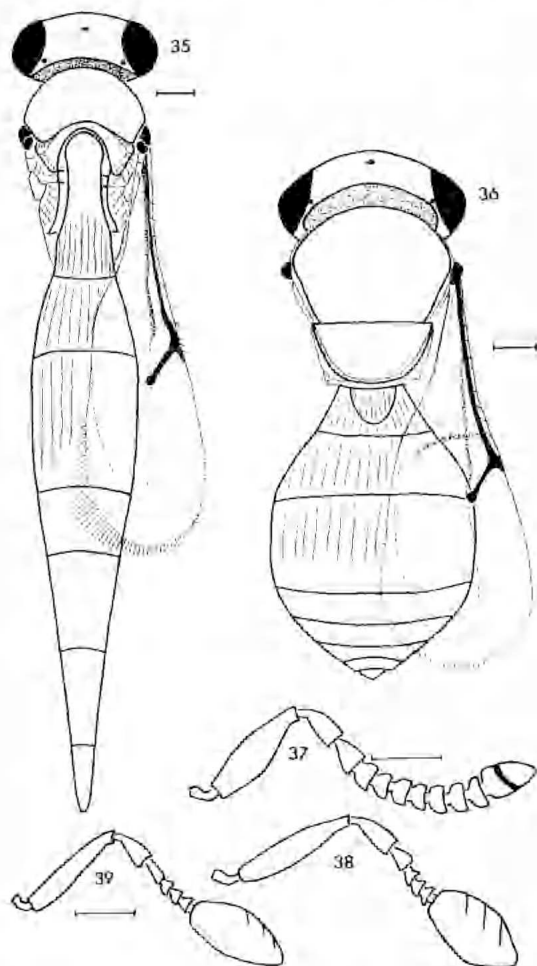


Fig. 35. *Ceratobaeus ricki*, ♀, dorsal surface of whole body. Fig. 36. *C. setosus*, ♀, dorsal surface of whole body. Figs 37-39. Antennae. 37. *C. setosus*, ♂. 38. *C. setosus*, ♀. 39. *C. ricki*, ♀. Scale lines = 100 µm. N.B. hairs and cilia not drawn on antennae and wings.

(8:16); notauli absent; scutellum transverse, L:W (1:10) with posterior fringe of long hairs; scutellum, metanotum and propodeum strongly excavated posteriorly for reception of horn; propodeal laminae vertical, without teeth dorsally (figs. 30 and 35).

Forewings fairly narrow, L:W (47:16), not reaching past T4, not infuscated; venation distinct, marginal and postmarginal veins

short, stigmal vein long, basal vein present but faint; marginal fringe of hairs moderately long (fig. 35).

Metasoma extremely elongated, approximately 4 \times longer than head and mesosoma combined, 6 \times longer than wide, L:W (90:15), covered with short hairs; horn long, strongly arched anteriorly, cylindrical but slightly flattened apically (fig. 30); T1-T3 including basal half of horn with longitudinal striations; lateral margins of T2-T3, and all T4-T7 with granulate sculpturing.

Male unknown.

Host unknown.

Non-type specimens examined: QUEENSLAND: Brisbane, Indooroopilly, 14.xii.76, Bouček, BMNH.

Comments

This species is named after its collector, Dr E. F. Riek. *C. riekii* is the largest species of *Ceratobæus* so far recorded in the world; its elongate metasoma being unlike that of any other species.

Ceratobæus setosus Dodd

FIGS 31-34, 36-38

Ceratobæus setosus Dodd 1914a, p. 65; Kieffer 1926, p. 142; Auslin 1981, p. 85.

Types: holotype ♀, head and wings on slide, No. 1966, SAM; Queensland, Gordonvale (Nelson), 29.x.1913, A. P. Dodd.

Female

Length 1.3-1.5 mm. Colour. Head and mesosoma black; antennae and legs brown to dark brown; dorsal metasoma dark brown to black, ventral surface dark brown.

Head, L:W:H (8.5:19:15), with granulate sculpturing, covered with dense mat of short hairs; dorsally squarish, slightly wider than mesosoma, not strongly excavated posteriorly; occipital carina sharp, not angled at corners; eyes large, covered with hairs; lateral ocelli touching inner margins of eyes; frons almost straight; anteriorly, head subtriangular in shape; occiput arched; eyes separated by more than 0.5 \times width of head; frons smooth and shiny; frontal carina very short; laterally, gena with margins converging, rounded ventrally (fig. 31); antenna (fig. 38), club with 3 faint incomplete sutures.

Mesosoma. Dorsally slightly arched, with granulate sculpturing, covered with dense mat of short hairs (fig. 32); pronotum not visible at anterior lateral corners; scutum not much

wider than long, L:W (11:14.5); notauli absent; scutellum semicircular, L:W (5:11), with crenulated posterior border (fig. 36); metanotum narrow and crenulated; posterior surface of propodeum vertical; laminae diverging slightly, extended into 2 small sharply pointed teeth dorsally (fig. 33); laterally, mesosoma smooth and shiny.

Forewings just reaching posterior margin of metasoma, L:W (38:15.5); marginal and postmarginal veins short, stigmal vein long, basal vein dark; marginal fringe of hairs short (fig. 36).

Metasoma broad and flat, wider than mesosoma, pointed posteriorly, L:W (30:19) (fig. 36), covered with dense mat of short hairs; horn vertical, just reaching to level of scutellum, with reticulate-rugose sculpturing apically (fig. 33); base of T1-T3 with longitudinal striations; lateral margins of T2-T3 and all T4-T6 with granulate sculpturing.

Male

Differing from female in the following: length 1.2-1.3 mm; antennae and legs light brown; metasoma dark brown; antenna (fig. 37); posterior mesosoma almost identical, except propodeal laminae diverging slightly more than in female; forewings long, reaching well past posterior metasoma, L:W (42:16); metasoma broad, slightly wider than mesosoma, rounded posteriorly, L:W (24:18); anterior T1 expanded dorsally into hump, not reaching above propodeum, longitudinal striations reaching to anterior margin (fig. 34); T2-T6 with long scattered hairs.

Comments

C. setosus has been recorded along the coast of Queensland and New South Wales. In New South Wales this species has been reared from the eggs of *Ixenticus robustus* (L. Koch) and *I. martius* (Simon) (Amaurobiidae), collected from around buildings and under bark of eucalypt trees. Another scorpionid, *Idris ixentici* (Hickman), has also been recorded as parasitising the eggs of these two spiders in Tasmania, Victoria, inland New South Wales and South Australia (Hickman 1967; Austin unpubl.). *C. setosus* can be easily recognised from all other species by its dense pilosity and sculpturing on the metasoma horn.

Non-type specimens examined: NEW SOUTH WALES: 1♂, 3♀, gold coated on SEM holders, wings and antennae of 1♂, 1♀ on slides, 1♀ dissected on slide, 4♂, 21♀, ANIC, 3♂, 17♀, CNC.

Pearl Beach, Jan. 1976, A.D.A., ex eggs *Ixentius robustus* (L. Koch) (Araneae); 1♂, 5♀, SAM; 1♂, 5♀, WAITE, Caringbah, 12.iii.1976, A.D.A.; 3♀, Pearl Beach, Jan. 1978, A.D.A., BMNH; 2♂, 4♀, Caringbah, 22.iii.1976, A.D.A., QDPI. QUEENSLAND: 1♀, Brisbane, Sept. 1928, A. D. Dodd; 1♀, Gógango, Dec. 1928, A. P. Dodd; 1♀, Gordonvale, Nov. 1920 (no collector), ANIC; 2♂, 2♀, Maleny, 14.vi.1973, M. D. (D.A.I.); 1♀, 600–700 m Sunday Creek nr Limna, 28–29.ix. 1974, I. Naumann, QDPI.

Acknowledgements

I thank Dr G. Gross, South Australian Museum, Dr I. D. Naumann and Ms J. C.

Cardale, CSIRO, and Mr E. C. Dahms and Dr G. B. Monteith, Queensland Museum, for their hospitality while visiting the above institutions and for loan of type specimens. I am grateful to Dr L. Masner and Dr I. D. Galloway for their helpful suggestions, and to Dr K. Bartusek for assistance with SEM techniques. Early drafts of the manuscript were read and substantially improved by Prof. T. O. Browning, Dr P. W. Miles and Sally Austin. Financial support for this study was provided by a URG Scholarship from the University of Adelaide.

References

- ASHMEAD, W. H. (1893) A monograph of the North American Proctotrypidae. *Bull. U.S. natn. Mus.* **45**, 1–472.
- ASKEW, R. R. (1971) "Parasitic Insects". (Heinemann Educational Books, London).
- AUSTIN, A. D. (1981) The types of Australian species in the Tribes Idrini, Bacini and Embidoblini (Hymenoptera: Scelionidae: Scelioninae). *Gen. Appl. Ent.* **13**, 81–92.
- (1983) Morphology and mechanics of the ovipositor system of *Ceratobaeus* Ashmead (Hymenoptera: Scelionidae) and related genera. *Int. J. Insect Morphol. Embryol.* **12**, 139–155.
- (in press) The fecundity, development and host relationships of *Ceratobaeus* (Hymenoptera: Scelionidae). *Ecol. Ent.*
- DODD, A. P. (1913) Further additions to the Australian Proctotrypoidea. *Arch. f. Naturg.* **79** Abt. A, Heft, **8**, 77–91.
- (1914a) Australian Hymenoptera Proctotrypoidea No. 2. *Trans. R. Soc. S. Aust.* **38**, 58–131.
- (1914b) Further new genera and species of Australian Proctotrypoidea. *Proc. R. Soc. Qd* **26**, 91–140.
- (1915) Australian Hymenoptera Proctotrypoidea No. 3. *Trans. R. Soc. S. Aust.* **39**, 384–454.
- (1919) Notes on exotic Proctotrypoidea in the British and Oxford University Museums, with descriptions of new genera and species. *Trans. R. ent. Soc. Soc. Lond.* **67**, 321–82.
- GALLOWAY, I. D. & AUSTIN, A. D. (in press) A revision of the Scelioninae (Hymenoptera: Scelionidae) of Australia. *Aust. J. Zool. Suppl. Ser.* No. 99.
- GIBBONS, J. R. H. (1979) A model for sympatric speciation in *Megarhyssa* (Hymenoptera: Ichneumonidae): competitive speciation. *Am. Nat.* **114**, 719–41.
- GIRAULT, A. A. (1926) New pests from Australia. V. Private Publication, Brisbane, 20 December 1926. 2 pp.
- HEATWOLE, H. & DAVIS, D. M. (1965) Ecology of three species of parasitic insects of the genus *Megarhyssa* (Hymenoptera: Ichneumonidae). *Ecology* **46**, 140–50.
- HICKMAN, V. V. (1967) New Scelionidae (Hymenoptera) which lay their eggs in those of spiders. *J. ent. Soc. Aust. (N.S.W.)* **4**, 15–39.
- HUGGERT, L. (1979) Revision of the Palaearctic species of the genus *Idris* Förster s.l. (Hymenoptera, Proctotrypoidea: Scelionidae). *Ent. Scand. Suppl.* **12**, 1–60.
- INTERNATIONAL COMMISSION ON ZOOLOGICAL NOMENCLATURE (1964) *International Code for Zoological Nomenclature*, London, xx, 176 pp.
- KIEFFER, J. J. (1926) Hymenoptera, Proctotrypoidea, Scelionidae. *Das Tierreich* **48**, 1–885.
- MASNER, L. (1976) Revisionary notes and keys to world genera of Scelionidae (Hymenoptera: Proctotrypoidea). *Mem. ent. Soc. Can.* **97**, 1–87.
- (1980) Keys to genera of Scelionidae of the Holarctic region, with descriptions of new genera and species (Hymenoptera: Proctotrypoidea). *Ibid.* **113**, 1–54.
- PRICE, P. W. (1972) Parasitoids utilizing the same host: adaptive nature of differences in size and form. *Ecology* **53**, 190–95.
- ROBINSON, B. W. (1980) The backscattered-electron low-vacuum S.E.M. technique: a user's evaluation. *Micron* **11**, 333–4.